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RECEIVED

December 22, 1997

DEC 22 1997

HAND DELIVERED

Magalie Salas, Esquire
Secretary
Federal Communications Commission
1919 M Street NW, Room 222
Washington DC 20554

FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

Re: Sierra Digital Communications, Inc.
Petition for Rule Making to Accommodate Point-to-Point Operations in the
24 GHz Band Under Part 15 of the Commission's Rules
RM-9189

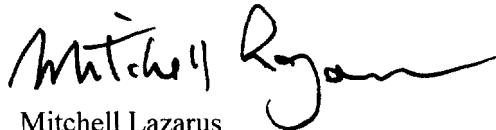
Dear Ms. Salas:

On behalf of Sierra Digital Communications, Inc. and pursuant to Section 1.405(b) of the Commission's Rules, I enclose herewith for filing with the Commission the original and nine copies of Reply of Sierra Digital Communications, Inc. to Comments of the American Radio Relay League, Incorporated in the above-captioned proceeding.

Kindly date-stamp and return the extra copy of this cover letter.

If there any questions about this filing, please contact me directly at the address above.

Respectfully submitted,



Mitchell Lazarus
Counsel for Sierra Digital Communications, Inc.

ML:deb

Enclosures

cc: Service List
Mr. Hal Tenney

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ORIGINAL

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington DC 20554

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DEC 22 1997

In the Matter of)

Sierra Digital Communications, Inc.)

Petition for Rule Making to Accommodate)

Point-to-Point Operations in the 24 GHz Band)

Under Part 15 of the Commission's Rules)

FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

RM-9189

REPLY OF SIERRA DIGITAL COMMUNICATIONS, INC.
TO COMMENTS OF THE AMERICAN
RADIO RELAY LEAGUE, INCORPORATED

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11th Floor
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December 22, 1997

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington DC 20554

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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

In the Matter of)
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Sierra Digital Communications, Inc.)
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Petition for Rule Making to Accommodate)
Point-to-Point Operations in the 24 GHz Band)
Under Part 15 of the Commission's Rules)

**REPLY OF SIERRA DIGITAL COMMUNICATIONS, INC.
TO COMMENTS OF THE AMERICAN
RADIO RELAY LEAGUE, INCORPORATED**

Sierra Digital Communications, Inc. (Sierra) hereby replies to the Comments of the American Radio Relay League, Incorporated (ARRL) filed on December 5, 1997.

Lacking either a factual or legal basis for its opposition to Sierra's proposal, ARRL resorts to unsupported rhetoric. As shown below, ARRL's objections have no merit and evaporate on examination.

A. ARRL's Opposition Rests on Mischaracterizations of Sierra's Petition.

ARRL proceeds by first mischaracterizing Sierra's proposal, and then attacking its own misconception, without reference to the actual proposal. Some examples:

- ARRL repeatedly describes Sierra's proposed transmitters as "high-powered,"¹ even though ARRL acknowledges the output power is under 1 milliwatt.²

¹ ARRL Comments at 3, 4, 7.

² ARRL Comments at 2.

- ARRL says Sierra's proposal involves power “far and away beyond that permitted for any other Part 15 device.”³ But much more output power is permitted to other Part 15 devices, including field disturbance sensors at 24 GHz⁴ and spread spectrum transmitters in other amateur bands.⁵
- ARRL repeatedly cites operation by “non-technical persons,” as though this somehow increased the potential for interference.⁶ Part 15 does not depend on operator skill for interference protection, but rather relies on circumscribing the area of potential interference (which Sierra does not propose to increase).⁷
- ARRL asserts that point-to-point communications are “a complete abandonment of the entire Part 15 unlicensed device concept,” and that Sierra's proposal is “plainly impermissible” under Part 15.⁸ In fact, point-to-point operations are hardly a novelty, but are commonplace under Part 15 — for example, in the 900, 2400, and 5800 MHz bands. Permitted output power in the 5800 MHz band is 1,000 times that requested here, with unlimited antenna gain.⁹
- ARRL refers to an “undue risk of excessive RF exposure.”¹⁰ This is absurd. All Part 15 devices are categorically excluded from routine RF evaluation. The

³ ARRL Comments at 6.

⁴ 47 C.F.R. § 15.245(b). Field disturbance sensors are permitted the same field strength requested here, but typically use antennas with gains about 20 dB less than the minimum 33 dBi that Sierra proposes. Accordingly, their output power is typically about 100 times higher.

⁵ 47 C.F.R. § 15.247(b) (one watt output power).

⁶ ARRL Comments at 5, 6.

⁷ In any event, Sierra anticipates that most, if not all, units marketed under the proposed rule will be sold through value-added resellers and will be professionally installed by technically trained personnel.

⁸ ARRL Comments at 3, 4.

⁹ 47 C.F.R. § 15.247(b)(3). All three bands permit a full watt of output power, although the 2400 band carries a penalty of 1 dB for each 3 dB of antenna gain over 6 dBi. The penalty in the 900 MHz band is 1 dB for each 1 dB of antenna gain over 6 dBi.

¹⁰ ARRL Comments at 5.

lowest EIRP in any service requiring routine RF evaluation is 164 watts, many times higher than the power levels at issue here.¹¹

As shown below, the facts fail to bear out ARRL's allegations.¹²

B. ARRL Misstates the Risk of Interference from Sierra's Proposal.

ARRL's most serious misrepresentation is its implication that Sierra's proposal would cause interference to amateur operations, particularly to satellite communications at 24.00-24.05 GHz. But ARRL does not actually make that allegation in so many words.¹³ Indeed, ARRL's careful wording betrays its understanding that Sierra's proposal in fact would not increase the potential for actual interference to amateur operations, including amateur satellite communications.

1. Sierra's proposal does not increase the area over which Part 15 devices may cause interference.

The present Part 15 rules at 24 GHz permit omnidirectional operation at 250 mV/m.¹⁴

The resulting interference contour is a circle whose radius depends on the victim receiver's level

¹¹ 47 C.F.R. § 1.1307(b)(1) (Table 1).

¹² ARRL also questions the legality of Part 15 operation under the Communications Act. ARRL Comments at 4. Neither the Commission nor any court has ever shared those doubts. To the contrary, the Commission has permitted unlicensed operation since 1938, Revision of Part 15, 4 FCC Rcd 3493, 3494 (1989), and Part 15 has become a major force in the economy. Location and Monitoring Service, 10 FCC Rcd 4695, 4712 (1995) (*e.g.*, more than 4,000,000 Part 15 devices in the 902-928 MHz band alone). If ARRL seriously wants to challenge the legal basis of Part 15, it should file a motion for a declaratory ruling. This is not the right proceeding to raise that question.

¹³ This circumlocution is ARRL's closest approach to a flat statement: "It could not be suggested that there would be no interference from a transmitter operating at 2.5 V/m at 3 meters to amateur satellite receivers." ARRL Comments at 2 n.2. To the contrary, Sierra not only suggests this proposition but demonstrates its truth, below.

¹⁴ 47 C.F.R. § 15.249(a). All field strength measurements are at 3 meters.

of tolerable interference. Under Sierra's proposal, for any specified interference threshold, the shape of the interference contour changes from a circle to a longer, narrower shape, **but the area does not increase**. In fact, the area over which interference can occur is actually reduced. (See the attached Technical Appendix.) The Commission has used exactly this analysis in the past when allowing Part 15 users at 2400 MHz to trade off higher EIRP for narrower beamwidth.¹⁵ Reducing the area even more is the fact that poor propagation at 24 GHz causes signal strength to fall off rapidly away from the transmitting antenna.

ARRL correctly notes the equal-area precedent arose in the context of spread spectrum point-to-point operations;¹⁶ and it is true that spread spectrum signals present less interference potential than narrowband signals **at the same power level**. But signal spreading is only one factor in assessing the risk of interference. Power is another. Transmitters under Sierra's proposal would operate at less than 1 milliwatt, under 1/1000 the output power permitted to spread spectrum. Moreover, spread spectrum at 5.8 GHz is permitted unlimited antenna gain with no power penalty.¹⁷ Sierra, in contrast, proposes to reduce output power by 13 dB from that permitted for omnidirectional operation, in exchange for the use of a high-gain antenna.¹⁸ In any

¹⁵ Spread Spectrum Transmitters, 7 Comm. Reg. 534, 541 (1997). The Commission used the analysis in arriving at a penalty of 1 dB of output power for each 3 dB of antenna gain for 2400 MHz spread spectrum operations.

¹⁶ ARRL at 6-7.

¹⁷ 47 C.F.R. § 15.247(b)(3)(ii).

¹⁸ The 13 dB figure results from the 33 dB antenna gain requirement, minus a 20 dB increase in EIRP (from 250 mV/m to 2500 mV/m).

event, the comparison of areas within the interference contour is the most practical way to assess the potential interference impact of the proposed rule change.

Significantly, ARRL does not allege actual interference under the current rules. Because Sierra's proposal does not increase the risk of interference, it will be equally harmless to amateur operations. And even if actual interference did occur, the Part 15 transmitter would have to yield to the amateur operator.¹⁹ All Part 15 transmitters are so labeled.²⁰

2. Actual interference, even to satellite operations, is extremely unlikely to occur in practice.

According to ARRL's own journal, the 24 GHz transmitter on the Phase 3D satellite will operate at only one watt, and only at the farthest portion of the orbit, which will be 30,000 miles (48,270 km) above ground.²¹ Based on its own expertise in microwave frequency

¹⁹ 47 C.F.R. § 15.5(c).

²⁰ 47 C.F.R. § 15.19(a)(3).

²¹ 81 *QST* No. 1 at 29 (Jan. 1997) (orbit); 81 *QST* No. 5 at 30 (May 1997) (24 GHz power levels). The satellite's 24 GHz transmitter will operate only at the farthest part of its highly elliptical orbit. *Id.*

ARRL's journal describes the 24 GHz operation in these terms:

In addition to Phase 3D's array of high-power transponders, there is an interesting experimental module designed and built by a group of Belgian amateurs. This is the K-band transponder generating a single watt of RF in the 24-GHz band. . . .

When you're this high in microwave territory, you're well beyond off-the-shelf, plug-and-play experience. For example, you won't find 24-GHz transverters at your favorite Amateur Radio dealer, but they are available if you're willing to shop around. . . .

The transponder is tentatively scheduled to be active during the highest portion of Phase 3D's orbit. Compare the vast distance with the low output power

communications, Sierra concludes that amateur receivers will have to be highly directional to have any hope of picking up this signal reliably. This fact reduces the likelihood of interference far below that represented by the current rule.²² The proposed rule requires that transmitters be highly directional. Moreover, point-to-point communications are invariably close to the horizontal plane. It follows that interference to an amateur satellite receiver can occur only if **all** of these conditions are met simultaneously:

- (a) the satellite is at the horizon,
- (b) the victim receiver lies within the transmitter beam — *i.e.*, within 1.8 degrees of the transmitter axis,
- (c) the axis of the victim receiver is oriented directly toward the transmitter, and
- (d) the receiver is in near proximity with the transmitter, with visible line-of-sight.

Even assuming several transmitters and receivers in the same geographical region, this combination of occurrences is astronomically unlikely. Reducing them even further is the fact that Sierra's proposal has no conceivable residential applications, while most amateur stations are located at residential sites. Indeed, Sierra would not object to a rule provision that prohibits

and you have a challenging situation. That's the point, though. The 24-GHz transponder functions much like a cape in the hand of a bullfighter, tempting us to action. Will we dare leave the cozy world of appliance operating and venture into — shudder — microwave homebrewing? *Id.*

²² Note, however, that even an amateur operator who attempts to receive the 24 GHz satellite signal with a nondirectional antenna will still fare no worse under Sierra's proposal than under the current rules.

marketing to consumers and other residential users, limits operation to non-residential sites, and requires devices certified under the rule to be labeled to prohibit use at residential sites.²³

Although the likelihood of interference is extremely remote to begin with, any that did occur would be short-lived. Phase 3D is a low-earth-orbit satellite with an orbit of 18 hours relative to any fixed location on earth. If the receiving antenna has a reasonably high gain, any interference cannot last more than a few minutes. And again, the Part 15 transmitter would have to cease operations until the interference is corrected.²⁴

²³ The Commission has successfully applied similar distinctions between residential and non-residential applications in the Class A/Class B digital device marketing rules, and in the rules applicable to consumer and non-consumer ISM equipment.

²⁴ Sierra's Petition for Rule Making proposed: "Point-to-point users must first employ frequencies at 24.05-24.25 GHz, and may tune into the 24.00-24.05 GHz sub-band only if all other frequencies are in use or otherwise unavailable." Sierra Petition for Rule Making at 5 (filed Sept. 29, 1997) (footnote omitted). This idea was not well received. Not only did ARRL reject it as "offer[ing] absolutely no assurance of interference protection," ARRL Comments at 5, but a Part 15 manufacturer that otherwise supports Sierra's proposal disfavors the provision on the ground that it would have the effect of "channelizing" the band in a manner antithetical to Part 15 regulatory policy. Comments in Support of Petition for Rule Making of Metricom, Inc. at 2 (filed Dec. 5, 1997). Metricom also believes the provision is unnecessary because "any interference created by the proposed service would be negligible." *Id.*

Sierra agrees with Metricom that the provision is unnecessary in practice and may have undesirable consequences for Part 15, but made the suggestion nonetheless in an excess of caution to reassure the amateur radio community that its satellite operations would be safe from interference. If the amateur radio community does not believe the idea affords it any incremental protection, then Sierra is happy to withdraw it.

C. ARRL's Proposed Alternatives Are Not Interchangeable with 24 GHz Part 15 Operation.

ARRL suggests several alternatives to Part 15 operation at 24 GHz for point-to-point communications.²⁵ One or more of these may be feasible in some cases, but not in all. The choice of optimal frequency band for a given communication task is often complex. It depends on such factors as antenna size for a given beamwidth, propagation characteristics, licensing requirements, need for frequency coordination, frequency congestion, required capacity, available lead time, expected longevity of the installation, terrain, soil composition (for trenching), and — often most important of all — cost of equipment.

Sierra provides the following responses to ARRL's proposed alternatives to point-to-point operation under Part 15.

- *Part 101*: Requires long lead times; entails costs and delays to accommodate need for frequency coordination and licensing that are unnecessary and unproductive for short-range service; some bands are limited to particular types of applications; prohibitive frequency congestion in many areas, particularly in built-up urban areas where short-range point-to-point communications are most likely to be needed.
- *above 40 GHz*: Equipment is still too expensive for many applications.
- *2 GHz PCS and 5 GHz U-NII*: Suitable only for very limited point-to-point applications, generally those with long-lived installations requiring extraordinary reliability, and where cost is not the major criterion. The 33 dB antenna required for proposed narrowbeam operation (3.5 degree beamwidth) would be 12 feet across at 2 GHz for the same efficiency, and 5 feet across at 5 GHz. These antennas require expensive and permanent supports. Smaller, less costly antennas broaden the beam, reduce frequency re-use, and risk unacceptable interference.

²⁵

ARRL Comments at 3-4.

- *existing wireline facilities*: Expensive to lease from telco; expensive to install; and often infeasible for particular communications needs (depending on terrain and accessibility).

Communications users are the persons best positioned to select from the marketplace whatever technologies best meet their needs. The Commission facilitates this process by making available the greatest possible range of technologies with the least possible regulation of each, consistent with effective sharing of the spectrum. Sierra's proposal would give short-range point-to-point users an additional technological option without increasing the risk of interference to other services.

D. CONCLUSION

Every user group would prefer to have its own, exclusive spectrum allocation. But that is impossible — there is simply not enough spectrum to go around. As a result, most users must share frequency bands with others. The Commission's task in setting technical rules is to allow each group the maximum flexibility to meet its own needs, without causing excessive interference risks to higher-priority users in the band. Part 15 has been a spectacularly successful approach to this problem, an effective regulatory technique for squeezing more use from limited spectrum.

The amateur community presently operates alongside 24 GHz Part 15 transmitters authorized at 250 mV/m over a full circle. ARRL does not allege any cases of actual interference from these transmitters. The amateur community also tolerates wide-beam field disturbance sensors at 2500 mV/m over much of the 24 GHz band, again without allegations of interference. Sierra has shown its proposal offers no more risk of interference to amateur radio at 24 GHz than do present 250 mV/m operations. And for satellite operations using directional antennas (which

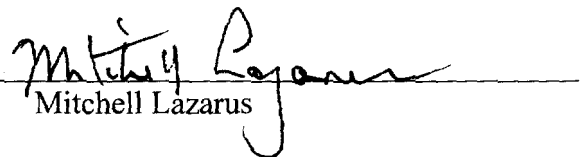
Sierra believes will be necessary in any event), the narrowbeam antennas that Sierra proposes will reduce the interference risks to far below present values.

Sierra appreciates the Commission's need for caution in any expansion of Part 15. But Sierra's proposal is not an expansion — it merely reshapes the zone of possible interference, without increasing its size. Amateur radio operators will not be harmed by the rule change.

The public-interest balance is clear. A grant of Sierra's Petition will provide the public with access to transportable, quickly-installed, inexpensive point-to-point communications, with no increased risk of interference to other users of the band.

Respectfully submitted,

SIERRA DIGITAL COMMUNICATIONS, INC.

By: 
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December 22, 1997

TECHNICAL APPENDIX

IMPACT OF PROPOSED RULE CHANGE ON RISK OF INTERFERENCE

The specification without the waiver is 250 mV/m. The proposed rule change requests an increase to 2500 mV/m. Both are measured at 3 meters from the radiator and follow the formula:

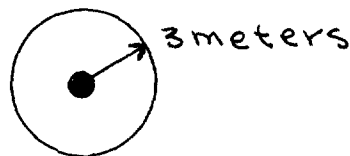
$$\frac{PG}{4\pi D^2} = \frac{E^2}{120\pi}$$

Where P = RF Power in Watts
 G = antenna gain
 D = measurement distance in meters
 E = field strength in V/m

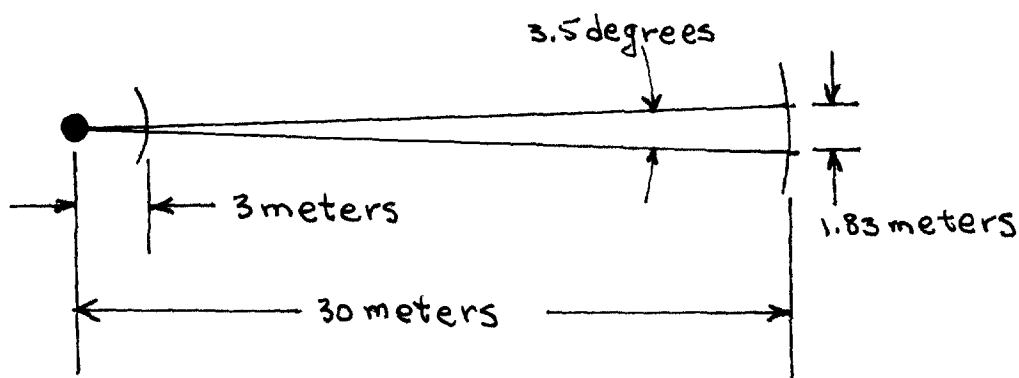
The proposed rule change requires that the antenna have a gain of 33 dB which is equivalent to a beam width of about 3.5 Degrees. Within this beam width, the field strength is 2500 mV/m at 3 meters and drops to 250 mV/m at 30 meters.

While power densities are computed as volume related, the interference is typically two dimensional.

Current specification of 250 mV/m at 3 meters.



Proposed rule conditions of 2500 mV/m at 3 meters.



In essence the waiver request would actually reduce the potential interference area from that caused by an isotropic radiator with 20 dB less equivalent power.

Example

The area over which the 250 mV/m condition exists can be determined for the two conditions, ie:

For the Isotropic Radiator (Gain - unity) and 250 mV/m

$$\text{Area} = \pi r^2 = \pi(3)^2 = 28.3 \text{ m}^2$$

For the 33 dB Gain (3.5 degree beam width) antenna and 2500 mV/m

$$\pi r^2 = \pi(10r)^2 \times \frac{\phi}{360} \quad \begin{array}{l} \text{(10 times the distance to the 250 mV/m contour} \\ \text{for 20 dB more output power, over a beam} \\ \text{width of } \phi \text{ degrees)} \end{array}$$

$$\text{Area} = \pi r^2 \times \frac{\phi}{360} = \frac{\pi(30)^2 \times 3.5}{360} = 27.5 \text{ m}^2$$

As can be seen, there is no penalty in net area of interference potential as long as the antenna beam width is less than 3.6 degrees.

The same calculation applies, and the same conclusion holds, for any selected interference threshold. For example, at an interference threshold down 20 dB from 250 mV/m, r is 30 m. The area of that threshold contour under the present rule is 2827 m² and under the proposed rule is only 2749 m².

CERTIFICATE OF SERVICE

I, Deborah N. Lunt, a secretary in the law firm of Fletcher, Heald & Hildreth, P.L.C., do hereby certify that true copies of the foregoing **"Reply of Sierra Digital Communications, Inc., to Comments of the American Radio Relay League, Incorporated"** was sent this 22nd day of December, 1997, by first class mail, postage prepaid, to the following:

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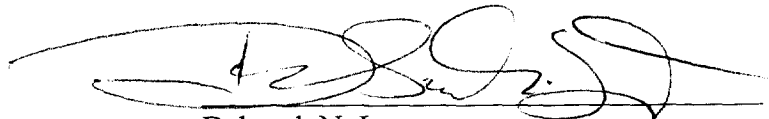
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